Case Report Rapport de cas

Accidental entrapment of cats in front-loading washing machines

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Abstract — Two clinical cases of accidental entrapment of cats in front-loading washing machines are described. One cat died the day after presentation as a result of aspiration pneumonia and head trauma, despite supportive care. The second cat survived with supportive treatment, but developed dermatologic complications 10 d later.

Résumé — Piégeage accidentel de chats dans les laveuses à chargement frontal. Deux cas cliniques de piégeage accidentel de chats dans des laveuses à chargement frontal sont décrits. Un chat est mort le jour après l'arrivée en raison d'une pneumonie de déglutition et d'un traumatisme crânien, malgré des soins de soutien. Le deuxième a survécu avec des soins de soutien, mais a développé des complications dermatologiques 10 jours plus tard.

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Case 1

A 3-month-old, 1.36 kg intact female domestic shorthair kitten was presented after being inadvertently trapped in a front-loading washing machine for an estimated 5 to 10 min on the hot cycle. The water contained a natural pH-balanced laundry detergent liquid (MelaPower; Melaleuca, Idaho Falls, Idaho, USA), with no bleach or fabric softener. The kitten was rushed to the primary care veterinarian. On presentation, her coat was wet and she was open mouth breathing. Rectal temperature was 37.8°C, and heart rate was 142 beats/min. Oxygen was administered by mask, and the kitten was wrapped in warm blankets. An intravenous (IV) cephalic catheter was placed, and warm Normosol-R (Hospira Healthcare Corporation, Montreal, Quebec) was administered at 3 mL/kg body weight (BW)/h. Thirty minutes later, her rectal temperature dropped to 34.8°C and oxygen saturation dropped to 85%, so she was referred to the Small Animal Veterinary Teaching Hospital (SAVTH) at the Western College of Veterinary Medicine (WCVM), University of Saskatchewan. During the trip to the VTH the kitten was agitated but alert, and vomited once.

Description

On physical examination the kitten was depressed and minimally responsive. Her hair coat was covered in vomitus and diarrheic feces, and there was bruising of the external pinnae with erythematous ear canals. Rectal temperature, heart rate, and respiratory rate were 35.4°C, 200 beats/min, and 80 breaths/min, respectively. Her mucous membranes were very pale, pupils were miotic and nonresponsive to light bilaterally, menace response was absent bilaterally, and a mild head tilt to the right was present. Breathing was labored with an obvious abdominal component, and fluid bubbled from the kitten's nose and mouth on inspiration. Crackles were ausculted over all lung fields. During examination, she vomited a small volume of yellow, mucoid material and vocalized. According to the owner, the kitten's meow was more high-pitched than normal.

An emergency panel revealed a packed cell volume (PCV) of 48% [reference interval (RI): 28% to 48%], total solids (TS) of 69 g/L (RI: 56 to 84 g/L), blood glucose (Glucometer Elite; Bayer Healthcare, Toronto, Ontario) of 12.8 mmol/L (RI: 3.5 to 8.1 mmol/L), and blood urea nitrogen (Azostix; Bayer Healthcare, Toronto, Ontario) in the 15 to 26 mmol/L range (RI: 6.0 to 11.4 mmol/L). Attempts to obtain a pulse oximetry reading were unsuccessful. Supplemental oxygen was administered by mask initially, and then the kitten was moved to a closed incubator with oxygen supplied at 5 L/min. Warmed Normosol-R (Hospira) was administered at 3 mL/kg BW/h, IV. Passive surface re-warming was performed using a circulating water blanket, warm water bottles and a BAIR hugger (BAIR Hugger; Arizant Healthcare, Eden Prairie, Minnesota, USA). Mannitol (Mannitol 25%; Hospira) 0.5 g/kg BW, IV was administered to treat for suspected cerebral edema, and dexamethasone (Dexamethasone 5; Vetoquinol, Lavaltrie, Quebec) 0.25 mg/kg BW, intramuscularly (IM) was administered for suspected laryngeal and epiglottic edema. Following the mannitol both pupils became less miotic, so a second 0.5 mg/kg BW, IV dose was administered 2 h later. Thoracic radiographs showed a patchy alveolar pattern in the left caudal lung lobe. Differentials considered included pulmonary contusion, pulmonary edema or, non-cardiogenic pulmonary edema. Two

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hours after presentation, her rectal temperature had increased to 39.3°C so heat support was discontinued.

During the next 12 h the crackles and head tilt resolved and direct and consensual pupillary light responses returned. Although menace response was still absent bilaterally, the kitten appeared to be able to see. Body temperature fluctuated in response to the presence or absence of passive surface re-warming, ranging from 36.4°C to 39°C. Follow-up PCV and TS were normal at 39% and 61 g/L, respectively. Blepharospasm and conjunctival irritation developed bilaterally, so ophthalmic lubricant (Tear-Gel; Novartis, Mississauga, Ontario) was applied every 4 h. Bilateral green crusting nasal discharge developed, so ampicillin (Ampicillin sodium; Novopharm, Toronto, Ontario) 22 mg/kg BW, IV every 8 h, was administered. Buprenorphine (Buprenex; Reckitt Benckiser, Richmond, Virginia, USA) 0.02 mg/kg BW, IV every 6 h, was initiated for pain management after she began to vocalize in the morning; vocalization decreased following administration of the analgesic.

Approximately 20 h after presentation, the kitten's mucous membranes became pale and cyanotic despite ongoing oxygen supplementation. Two hours later, she became tachypneic and dyspneic and crackles were again ausculted bilaterally. Furosemide (Furosemide 5% Solution; Sandoz Canada, Quebec City, Quebec) 2 mg/kg BW, IV was given for suspected pulmonary edema. Vomitus was found in the mouth upon examination, so suction of the oral cavity was performed. A second dose of dexamethasone (Vetoquinol), 0.1 mg/kg BW, IM, was administered to treat presumed laryngeal edema and chemical or thermal pneumonitis. One hour later, the kitten was found agonal in the oxygen cage. Upon administration of oxygen (100%) by mask, she resumed respiration but anisocoria developed. Furosemide (Sandoz Canada) 2 mg/kg BW, IV and mannitol (Hospira) 0.5 g/kg BW, IV were given along with a 5 mL 0.9% NaCl (Hospira) bolus. The kitten continued to deteriorate, and the owner elected for humane euthanasia.

A postmortem examination revealed severe suppurative and necrotizing aspiration pneumonia with food material in the oral cavity, oropharynx, larynx, esophagus, and major airways of the lung. Histopathology revealed flooding of the alveoli with protein-rich fluid. Fibrin was evident in some alveoli near bronchi and bronchioles that were filled with neutrophils, necrotic and foreign material and bacterial colonies. The mucosa of many airways had sloughed where there was contact with the aspirated material. Culture from the lung grew 3+ *Escherichia coli* and 2+ *Proteus mirabilis.* Focal epithelial necrosis over the laryngeal tonsils was also observed. A suggestion of perivascular edema and a few tiny perivascular hemorrhages was observed in the kitten's brain and spinal cord sections. There was no evidence of hypoxic neuronal damage.

Case 2

An 8-year-old, 4.28 kg spayed female Himalayan cat was presented to the VTH emergency service after being inadvertently trapped in a front-loading washing machine for 1 min on the hot cycle. The water contained a concentrated, high efficiency pH-balanced laundry detergent liquid (Tide High Efficiency Liquid Original Scent; Proctor & Gamble, Cincinnati, Ohio, USA), with no bleach or fabric softener.

Description

On physical examination, the cat was conscious and was not exhibiting any signs of head trauma, but was visibly agitated. Rectal temperature, heart rate, and respiratory rate were 37.9°C, 200 beats/min, and 66 breaths/min, respectively. Erythema of the base of her ears and periocular skin was noted. The cat was tachypneic and dyspneic, with increased bronchovesicular sounds and wheezes ausculted over all lung fields. The PCV was 48%, TS was 80 g/L, and blood urea nitrogen was in the 15 to 26 mmol/L range. A jugular venous blood gas analysis revealed stress hyperglycemia (glucose = 8.6 mmol/L; RI: 3.5 to 8.1 mmol/L) and hyperlactemia (lactate = 3.7 mmol/L; RI: 0 to 2 mmol/L). Serial thoracic radiographs taken at presentation and 30 min later showed no obvious abnormalities. A cephalic IV catheter was placed, and IV Normosol-R (Hospira) with 15 mEq KCl/L (Hospira) was administered at a rate of 2 mL/kg BW/h. The cat was placed in an oxygen cage with an oxygen flow of 4.5 L/min. Respirations became less labored, and the cat appeared less agitated. Oxygen saturation (Vet/OX 4400; Heska Corporation, Flamborough, Ontario) was monitored overnight, and ranged from 82% to 98%. The oxygen flow rate was gradually decreased overnight and discontinued 18 h later. Oxygen saturation remained at 99%, and the cat's dyspnea and increased bronchovesicular sounds and wheezes completely resolved. She was discharged from the hospital 36 h after initial admission.

Ten days later, the cat was presented to the VTH for a 2-day history of persistent licking of her side and increased reclusive behavior. Temperature, pulse, and respiration were all within normal limits. An extensive, coalescing, crusting skin lesion with purulent exudate was observed on the ventral and right abdomen and the right lateral thorax, along with a few small crusting lesions on the forehead. There was no prior history of any dermatologic disease. Impression smears revealed suppurative inflammation and a few gram-positive cocci. The cat was sedated with butorphanol (Torbugesic; Wyeth Canada, St. Laurent, Quebec) 0.05 mg/kg BW, IV and medetomidine (Domitor; Pfizer Animal Health, New York, New York, USA) 0.005 mg/kg BW, IV, and the lesions were clipped and scrubbed with diluted chlorhexidine (Stanhexidine; Omega Laboratories, Montreal, Quebec). She was discharged with an Elizabethan collar to prevent self trauma, and the owner was instructed to apply Burrow's Solution (Burrow's 2%, Hydrocortisone 1% in Propylene Glycol; WCVM-VTH Pharmacy, Saskatoon, Saskatchewan) as a compress twice daily to the skin lesions. Pruritis persisted, and healing was delayed by continual self-mutilation in spite of the Elizabethan collar. The owners had some baby clothes modified for the cat to keep her from licking at the wounds, and the lesions finally resolved 2 mo later.

Discussion

As illustrated in these cases, animals entrapped in functioning washing machines are at risk for near-drowning, aspiration pneumonia, chemical damage to body tissues, thermal injury, and head trauma. Both patients exhibited clinical signs of

respiratory distress shortly after entrapment, most likely associated with pulmonary edema caused by inhalation of water while in the washing machine. Patient 1 also showed radiographic signs consistent with pulmonary edema. Aspiration of water leading to pulmonary edema and hypoxia-induced organ damage has been recognized as a major cause of death in human and animal near-drowning victims (1–6). Thoracic radiographs should be taken at admission and repeated at regular intervals up to 48 h after the incident to monitor for progression of pulmonary edema, since radiographic signs may not be immediately apparent and typically worsen with time (3). Repeat radiographs were not obtained for Patient 1, but would have been valuable. While corticosteroid administration has been historically recommended as prophylaxis against pulmonary injury following near-drowning, several human studies have demonstrated that their use should be avoided due to the risk of developing secondary bacterial pneumonia (1–3,5). Judicious corticosteroid therapy may still be indicated in patients with laryngeal edema due to irritation from inhalation of detergents and/or hot water as was suspected in Patient 1 (7,8); however, it is possible that steroid use in this kitten contributed to worsening of aspiration pneumonia due to immunosuppression.

On postmortem examination Patient 1 had evidence of severe aspiration pneumonia, which likely contributed to her death. Vomiting was observed only twice, once during transport to the hospital and once during initial examination, and the initial findings on thoracic radiographs were not classical for aspiration pneumonia. However, the finding of vomitus in the oral cavity when the kitten deteriorated 20 h after presentation suggests that aspiration of vomitus may have been ongoing and the possibility of aspiration should have been more heavily considered.

Aspiration pneumonia is common in near-drowning cases. In addition to direct inhalation of water, significant amounts of fluid are often swallowed due to panic and stress; this places the patient at increased risk of vomiting and subsequent aspiration (2,3). Neurologic injury increases the risk of aspiration due to muscular in-coordination, weakness, and mental depression (2). Human studies have shown that at least 85% of near-drowning victims aspirate (2). Aspiration may not be immediately apparent, since radiographic changes may not allow discrimination between acute non-cardiogenic edema, chemical pulmonary injury, hemorrhage, and aspiration of water or vomitus (1,2). Prophylactic antibiotic therapy in near-drowning patients is generally not recommended since it does not improve survival rates or reduce the incidence of pneumonia and may predispose the patient to develop nosocomial or antimicrobial-resistant infections (1,2).

Vomiting, presence of vomitus in the pharynx, worsening dyspnea, pyrexia, leukocytosis, left shift and worsening alveolar or interstitial lung pattern on radiographs suggest that aspiration may have occurred and prompted a recommendation for a broad spectrum antibiotic (1,2). Antibiotic treatment was initiated in Patient 1 when a mucopurulent nasal discharge developed, but could have been initiated at admission due to the presence of vomiting and high probability of aspiration.

Chemical damage to the lungs, eyes, skin, gastrointestinal tract, and upper respiratory tissues can occur following exposure to and inhalation of laundry detergent present in wash water (7,8). Many laundry detergents are highly alkaline, increasing the risk of tissue injury with exposure (7,8). In the 2 cases reported here, the laundry detergents involved were balanced to a neutral pH, yet signs of dermal, conjunctival, gastrointestinal, and respiratory tract irritation were still observed. Hot water cycle exposure occurred in both patients, so it is possible that some of the clinical signs seen were related to thermal rather than chemical trauma. The exact temperature of the water was not known in either case. Washing machine water temperature is determined by the setting on the household hot water heater, which in Canada can be legally set to a maximum of 60°C (9), as well as the ratio of hot to cold water entering the washing machine. Third degree (full thickness) burns occur in 2 to 5 s in 60°C water, in 10 to 30 s in 55°C water, and in 5 to 10 min in 49°C water (9). Patient 2 may have experienced some degree of thermal trauma to the skin during her 1-minute exposure to water in the washing machine that was set to the hot cycle, leading to the crusting dermatitis with secondary bacterial infection. Similarly, the development of vomiting, diarrhea, blepharospasm, and a higher-pitched meow in Patient 1 may have been due to chemical or thermal trauma to the eyes, larynx, and gastrointestinal tract.

Head trauma associated with wash cycle agitation was probably the major cause of the neurologic abnormalities (mental dullness, anisocoria, and head tilt) seen in Patient 1, but hypoxic-ischemic brain injury associated with near-drowning likely also played a role. The absent menace response may have represented a true neurologic deficit as well, but could also be age-related as this reflex is learned between 10 and 12 wk of age (10). No neurologic abnormalities were seen in Patient 2. The larger size of this cat and her shorter exposure time in the washing machine likely contributed to limiting the extent of traumatic injury experienced. Maintenance of systemic blood pressure and administration of mannitol and or hypertonic saline are recommended to decrease intracranial pressure in patients with progressive cerebral edema (2,3). Mannitol was administered in Case 1, resulting in transient clinical improvement evidenced by resolution of the anisocoria and head tilt. Damage to the hypothalamus from head trauma, cerebral edema, and or cerebral hypoxia-ischemia may have contributed to loss of thermoregulatory function in Patient 1, leading to the large fluctuations in body temperature associated with heat support; however, some of these shifts may have been associated with the less well-developed thermoregulatory abilities seen in pediatric patients (11,12).

Front-loading washing machines provide easier entry access to pets than traditional top-loading models. As these machines become more widespread in the home, it is likely that accidents will increase in frequency. It is critical that veterinarians evaluating these patients at presentation conduct a complete assessment of all body systems and monitor for the wide range of clinical abnormalities that can occur. Even for patients presenting with a normal physical examination, admission for at least 24 h of observation is strongly recommended due to the risk of rapid clinical deterioration in these animals. It is also important to stress to owners that their pets must be closely watched at home for the first few days following discharge to monitor for late-onset clinical signs. CVJ

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